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AFTER FINAL EXPEDITED
PROCEDURE

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:

Katsumi MIYATA, et al.

Group Art Unit: 2827

Serial No.: 09/478,508

Examiner: GRAYBILL, D.

Filed: January 6, 2000

P.T.O. Confirmation No.: 1796

For: SEMICONDUCTOR DEVICE AND METHOD OF MANUFACTURING THE SAME

AMENDMENT AFTER FINAL REJECTION

BOX AF

Commissioner for Patents
Washington, D.C. 20231

August 21, 2002

Sir:

In response to the Office Action dated June 5, 2002, please amend the above-identified application
as follows:

IN THE CLAIMS:

Please AMEND claim 16 as follows:

- 1 16. (Amended) A semiconductor device having a semiconductor chip,
- 2 first electrodes formed on said semiconductor chip,
- 3 barrier metals formed on said first electrodes and having laminated structures, and

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4 a plurality of second protruded electrodes, which serve as external connection terminals, formed
5 on said barrier metals, wherein said barrier metals comprising:

6 a lowermost conductive metal layer laminated on said first electrodes, said lowermost
7 conductive metal layer having a joining property with said first electrodes;

8 an intermediate conductive metal layer laminated on said lowermost conductive metal layer,
9 said intermediate conductive metal layer being made of nickel (Ni); and

10 an uppermost conductive metal layer laminated on said intermediate conductive metal layer,
11 said uppermost conductive metal layer being made of a material which easily alloys with the nickel of said
12 intermediate conductive metal layer and which has resistance to oxidation, said uppermost conductive metal
13 layer being made of a metal selected from the group consisting of platinum (Pt), palladium (Pd), silver (Ag)
14 and rhodium (Rh) or of an alloy containing a metal selected from the group consisting of gold (Au), platinum
15 (Pt), palladium (Pd), silver (Ag) and rhodium (Rh).

REMARKS

Claims 16 and 17 are pending in this application. Reconsideration of the rejections in view of these amendments and the following remarks is respectfully requested.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment, which is captioned "Version with Markings to Show Changes Made."

Finality of the First Office Action

The Office Action has been made final. The finality of the Office Action, however, is improper and should be withdrawn. The MPEP §706.07(b) reads as follows:

The claims of a new application may be finally rejected in the first Office action in those situations where (A) the new application is a continuing application of, or a substitute for, an earlier application, and (B) **all claims of the new application (1) are drawn to the same invention claimed in the earlier application, and (2) would have been properly finally rejected on the grounds and art of record in the next Office action if they had been entered in the earlier application.**

(emphasis added). According to the requirement (1), the current claim 1 must have been claimed in the earlier application. A newly narrowed claim is not **"the same invention claimed in the earlier application."**

Current claim 1 is clearly narrower than claim 1 in the earlier application because the "intermediate conductive metal layer" no longer covers a plurality of layers. The subject matter, as currently claimed in claim 1, has never been examined in the earlier application. Therefore, the finality of the Office Action is inappropriate and should be withdrawn.

Also, the Office Action includes a §112, second paragraph rejection which could have raised new issues if presented after final.

Thus, the finality of the Office Action is improper and should be withdrawn.

Rejections under 35 USC §112, Second Paragraph

Claims 16 and 17 were rejected under 35 USC §112, second paragraph, as being indefinite because there is insufficient antecedent basis for the limitations, "said one or more intermediate conductive metal layers," and "said intermediate conductive metal layers."

Accordingly, claim 16 has been amended and the rejection has been overcome.

Rejections under 35 USC §102(b)

Claim 16 was rejected under 35 USC §102(b) as being anticipated by Cook (U.S. Patent No. 5,719,070).

Claim 16 has been amended to recite "said uppermost conductive metal layer is made of a metal selected from the group consisting of platinum (Pt), palladium (Pd), silver (Ag) and rhodium (Rh) or of an alloy containing a metal selected from the group consisting of platinum (Pt), palladium (Pd), silver (Ag) and rhodium (Rh)" **deleting gold (Au)** from the option of the metal of the uppermost conductive metal layer.

Cook describes as follows:

The metallization composite comprises a composite of a refractory metal, nickel (Ni), and copper (Cu), wherein the nickel forms an interface between the refractory metal and the copper. The nickel thereby prevents

degradation of the metallization composite at the interface, such as degradation by chlorine accelerated corrosion.

...

The refractory metal layer is preferably titanium (Ti), but other suitable refractory metals known to those skilled in the art can also be utilized. These include, for example, zirconium and hafnium.

An additional optional layer of gold (Au) can overlie the copper layer of the metallization composite.

The metallization composite of the subject invention is not subject to failure at the composite's metal-metal interfaces or other degradation problems. These problems are overcome, in accordance with the invention, by employing the intermediate layer/interface of nickel. It should also be noted that other combinations of metals have been tested, including: **Ti/Cu/Ni/Au; Ti/Pd/Cu/Au; Ti/Cu/Pd/Au; Ti/Al/Cu/Au; and Ti/Cr/Cu/Au** (Pd=palladium; Cr=chromium). The results in each case were unacceptable, as detailed below.

Thus, **in accordance with the subject invention, a Ni layer is interposed between Ti and Cu-Au** and the resulting structure is capable of surviving the multiple cleaning and heating cycles imposed by chip joining and rework. For example, the subject metallization composite can withstand at least 12 reflow cycles with 12 flux/perchlor cleaning cycles, and maintain bond integrity to a substrate. The simple Ti-Cu-Au structure fails under these conditions.

Col. 2, line 53 to col.3, line 25. Thus, Cook et al only discloses the uppermost layer of Cu or Au and does not teach or suggest that "said uppermost conductive metal layer is made of a metal selected from the group consisting of platinum (Pt), palladium (Pd), silver (Ag) and rhodium (Rh) or of an alloy containing a metal selected from the group consisting of platinum (Pt), palladium (Pd), silver (Ag) and rhodium (Rh)," as recited in claim 16.

For at least these reasons, claim 16, as amended, patentably distinguishes over Cook et al.

Rejections under 35 USC §103(a)

Claim 17 was rejected under 35 U.S.C. §103(a) as being obvious over Cook.

Claim 17, depending from claim 16, also patentably distinguishes over Cook et al for at least the same reason already discussed above.

In view of the aforementioned amendments and accompanying remarks, claims, as amended, are in condition for allowance, which action, at an early date, is requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicants undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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